

THE SYSTEMATIC STATUS OF CENTRAL AMERICAN FROGS CONFUSED WITH *ELEUTHERODACTYLUS CRUENTUS*

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Abstract.—*Eleutherodactylus cerasinus*, *E. cruentus*, and *E. ridens*, three superficially similar species from lower Central America, are re-diagnosed. Direct comparisons of type material show that *E. peraltae* Barbour, 1928, and *E. tiptoni* Lynch, 1964, are synonyms of *E. cerasinus*; *Syrrhophus lutosus* Barbour and Dunn, 1921, *E. dubitus* Taylor, 1952, and *E. marshae* Lynch, 1964 are synonyms of *E. cruentus*; and *Syrrhopus molinoi* Barbour, 1928 is a synonym of *E. ridens*.

A series of three superficially similar species of *Eleutherodactylus* from lower Central America have caused confusion for all workers on the genus. The forms share the following features: finger II longer than I; no toe webbing; large finger and toe disks; disk pads round, never triangular; disk covers round, palmate or truncate, never pointed; and venter coarsely areolate. The earliest name applied to these frogs is *Hylodes cruentus* W. Peters, 1873. Since that time eleven different names, eight proposed as new taxa, have been applied to these forms.

In the course of studies on the genus in Middle America, I have had the opportunity to see extensive new living and preserved material of the problematic populations and have examined all extant types of names involved in the problem. The following sections summarize my findings as a basis for a more extensive treatment of all Middle American species in the genus in a subsequent paper. The clarification of the taxonomy and synonymy for these forms is required at this time so that other workers may use the correct names in their systematic and ecological treatments.

Eleutherodactylus cruentus (W. Peters)

- 1873 *Hylodes cruentus* W. Peters, Mon. Akad. Wiss. Berlin: 609.
1921 *Syrrhophus lutosus* Barbour and Dunn, Proc. Biol. Soc. Wash. 34:158
(Holotype: MCZ 8023; Costa Rica: Cartago: Canton de Cartago: Navarro, 1100 m).
1931 *Eleutherodactylus ventrimarmoratus*: Dunn, Occ. Paps. Boston Soc. Nat. Hist. 5:411.
Eleutherodactylus lutosus lutosus: Dunn (by implication), Occ. Paps. Boston Soc. Nat. Hist. 5:411.

- 1933 *Eleutherodactylus latidiscus*: Dunn, Occ. Paps. Boston Soc. Nat. Hist. 8:68–69.
- 1952 *Eleutherodactylus dubitus* Taylor, Univ. Kansas Sci. Bull. 35(5):707, Fig. 22 (Holotype: KU 24942; Costa Rica: Alajuela: Canton de Alajuela: SE slope Volcan Poas: Isla Bonita, 1476 m).
- 1964 *Eleutherodactylus marshae* Lynch, J. Ohio Herp. Soc. 4(3):67, Fig. 3 (Holotype: BYU 18819; Panama: Bocas del Toro: Rio Changena, 35 km W Almirante).
- 1965 *Eleutherodactylus cruentus*: Savage, Bull. South. Calif. Acad. Sci. 64(2):109.

Holotype.—Berlin 7811; Panama: Provincia de Chiriquí.

The confusion surrounding proper application of the name *cruentus* stems from several sources. Two of these are biological. The first is the result of extensive sexual dimorphism in which the males are much smaller (maximum size 28 mm) than the females (to 42 mm), and are also much more tuberculate and tend to have a truncate snout often with a slightly fleshy pointed tip (females are smoother and usually with a subovoid snout in dorsal outline). In addition, the tympanum in males is completely hidden by skin, whereas in females it is indistinct but definitely visible. The second involves the extremely high variability in coloration, ranging from markedly patterned to nearly uniform tan to black in dorsal color, often with light areas on back, flanks, and thighs green, bright yellow, orange or red; groin usually with one to several large yellow to orange spots. Nevertheless, all individuals assigned to this species agree in having a distinct, enlarged, pointed or flap-like supraocular tubercle; a well developed, distinct, pointed heel tubercle; greatly expanded, truncate, emarginate finger disks; and the subarticular tubercles raised but not pointed.

The holotype of this species is an adult female, 39.5 mm in length, collected by Ribbe somewhere in the Chiriquí region of western Panamá. It agrees in every respect (see key couplets 1 and 2 below) with examples now known from Costa Rica and Panama, although the extensive suffusion of the dorsum with red (the source of the species name) described by W. Peters (1873) is an unusual variant. Recently collected female examples from above Boquete, Chiriquí Province, Panama, are often colored in a similar fashion.

When the unusual coloration of the type of *cruentus* and the marked sexual dimorphism of the species are taken into account, it is not surprising that Barbour and Dunn (1921) described *Syrrhophus lutosus* based upon a juvenile male, 13 mm in length. This example agrees in all ways with male *cruentus*. Difficulty arose later, however, when Dunn (1931) allied *lutosus* with the nominal species *Syrrhopus* [sic] *molinoi* Barbour (1928), by reducing the latter to subspecies status under *lutosus*. As we shall see later, *molinoi* belongs with a very different species population.

While confused about the relationships of “*lutosus*” and *molinoi* Dunn (1931, 1933) was well aware that *molinoi* differed from the species here called *cruentus*. He referred material of the latter from central and western Panama, first to *Eleutherodactylus ventrimarmoratus* (an Amazonian form) and then to *E. latidiscus* (a western South American species). At the same time he recognized a relative of *cruentus*, *Eleutherodactylus cerasinus* (Cope, 1875), as occurring on Barro Colorado Island, Panama. *Eleutherodactylus cerasinus* is distinctive in having the groin, posterior thigh, and calf suffused with red pigment in life, a condition never found in *cruentus*.

Sometime between 1931 and 1951, Dunn (in Zetek and Wetmore, 1951) apparently became convinced that *cruentus* was an older name for *cerasinus*. He thus applied the former to *cerasinus*, while using *latidiscus* for *cruentus*. As a result almost all examples of *cerasinus* at most United States museums were re-labeled *cruentus* by Dunn. One suspects the change came about because Dunn wanted to apply the old name *cruentus* to some Panama form. Although he had examined the type of *cruentus* at Berlin in 1928, his notes may have been inadequate and his memory somewhat diminished by the 23 year gap. Very likely the red on the thighs of *cerasinus* and the name *cruentus* (= bloody) influenced him. As we shall see below, the two names apply to distinctive species.

Taylor (1952) in his classic work on Costa Rica recognized *lutosus* and *cerasinus* as distinct. In addition he described as new *Eleutherodactylus dubitus*, based on a large and variable series including males and females, but with a female holotype, 38.5 mm in length. Taylor’s description covers a fair proportion of the variation in the species, but direct comparison of his type and the type of *cruentus* leaves no doubt as to their conspecificity.

Eleutherodactylus marshae Lynch, 1964 is a poorly fixed (the type and only known example appears to have died sometime well before preservation) adult male, 28 mm in length. The distinct black bars and bright yellow groin spots confirm the identification with *cruentus* made on the basis of direct comparison to Costa Rica and Panama material. The smooth venter and apparent tympanum mentioned in the original description are artifacts of death and desiccation prior to preservation. The type of *marshae* further agrees with adult male *cruentus* in having nuptial thumb pads and lacking vocal slits.

Eleutherodactylus cruentus differs from other Central American members of the genus with which it might be confused (exclusive of the two forms discussed in detail later in this paper) in having a well developed pointed to flap-like heel tubercle or calcar (absent in *E. altae* of Costa Rica and *E. pardalis* of Costa Rica and Panama); in having well developed accessory palmar tubercles and a series of 2–4 outer tarsal tubercles (absent in *E. caryophyllaceus* and *E. melanostictus* of Costa Rica and western Panama); and in having a distinct well developed pointed to flap-like supraocular tu-

bercle (absent in *taeniatus* of Panama, Colombia, and northwestern Ecuador).

The known geographic range of this species may be stated as follows: primarily humid forests in the premontane zone on both slopes of Costa Rica and western Panama; scattered lowland records in eastern and southwestern Costa Rica into central Panama (40–1550 m).

Referral of eastern Panama and Colombia material to this species (Lynch 1979) is subject to question and requires a detailed study and comparison of samples before their status can be resolved.

Eleutherodactylus cerasinus (Cope)

- 1875 *Hylodes cerasinus* Cope, J. Acad. Nat. Sci. Phila. 2(8):112, pl. 26, Fig. 4.
- 1921 *Eleutherodactylus cerasinus*: Barbour and Dunn, Proc. Biol. Soc. Wash. 34:161; 1952, Taylor, Univ. Kansas Sci. Bull. 35(5):703, Fig. 21.
- 1928 *Eleutherodactylus peraltae* Barbour, Proc. N. Engl. Zool. Club 10:30, pl. 4, Fig. 1 (Holotype: MCZ 13601; Costa Rica: Cartago: Canton de Turrialba: Peralta, 386 m).
- 1964 *Eleutherodactylus tiptoni* Lynch, J. Ohio Herp. Soc. 4(3):65, Fig. 2 (Holotype: BYU 19146; Panama: Bocas del Toro: 35 km W Almirante).
- 1951 *Eleutherodactylus cruentus*: Dunn in Zetek and Wetmore, Ann. Rept. Smithsonian Inst. 1950:140.

Holotype.—USNM 32572: Costa Rica: Provincia de Limon: Canton de Talamanca: Cerro Ujam, 1524–2134 m.

This species was described by Cope (1875) based on material from the expedition of William More Gabb to Cerro Ujam in southeastern Costa Rica. The holotype, an adult female 33 mm in length, is still extant but is in very poor condition. The frog clearly was not collected at the elevation indicated in the original description (Savage, 1970). This specimen has all the distinctive features of *cerasinus*: a well developed heel tubercle; no enlarged supraocular or superciliary tubercles; some subarticular tubercles under toes III–IV pungent to pointed; tympanum clear, distinct; no discrete light and dark markings on groin. The presence of red in the groin, on the posterior surface of the thigh, and on the inner face of the calf as described by Cope (1875) confirms the facts of morphology as supported by the original figure. The species was independently described by Barbour (1928) as *Eleutherodactylus peraltae* based on a juvenile 26 mm in length. This individual agrees in all diagnostic features with the type of *cerasinus* and material from localities near Peralta on the Atlantic slope of Costa Rica.

The type and only known specimen of *E. tiptoni* is a young female 24 mm in length, that appears to have died and become desiccated before preservation. Its distinctive features include: a well developed heel tubercle, a series of subequal superciliary tubercles, outer finger disks expanded but not emarginate and some subarticular tubercles pungent or pointed. In these features the type of *tiptoni* agrees with *E. cerasinus* as defined in this paper and approaches closely examples referred to the latter form from the Almirante area of northwestern Panama.

Eleutherodactylus cerasinus differs from *E. cruentus* in the many features given in the key below (couplet 2). The types of *cerasinus*, *peraltae* and *tiptoni* conform closely with this character suite. Dunn (in Zetek and Wetmore, 1951) used the name *cruentus* for an *Eleutherodactylus* population from Barro Colorado Island, Panama. A re-examination of material in many museum collections from the island and other areas in Costa Rica and Panama, identified by Dunn as *cruentus*, shows that he consistently misapplied the latter name to examples of *E. cerasinus*. Although Myers and Rand (1969) continued to use *cruentus* for Barro Colorado Island examples with some question, the species is not known to occur on the island and all references to its occurrence there are based on *cerasinus*.

Among Central American *Eleutherodactylus* that might be mistaken initially for *E. cerasinus*, each (beside the two forms reviewed in greater detail in this paper) may be readily separated from it as follows (features for *cerasinus* in parentheses): *E. altae* and *E. pardalis* lack a well developed heel tubercle and have large discrete light groin and thigh spots (tubercle present, no discrete light spots); *E. caryophyllaceus* has an enlarged superciliary tubercle (no enlarged superciliary tubercle, although a row of equal sized small superciliary tubercles usually present); *E. melanostictus* has a well developed supraocular tubercle (absent); and *E. taeniatus* has distinct narrow finger fringes, lacks superciliary tubercles, lacks red in the groin and on legs in life, and adult males have nuptial thumb pads (no distinct finger fringes, a series of small superciliary tubercles, red present in the groin and on legs in life, no nuptial thumb pads).

The known geographic range for this species is: the Atlantic lowlands and premontane slopes of Nicaragua, Costa Rica, and Panama, onto both versants in western and central Panama (40–1300 m).

Eleutherodactylus ridens (Cope)

- 1867 *Phyllobates ridens* Cope, Proc. Acad. Nat. Sci. Phila. 18:131.
- 1885 *Hypodictyon ridens*: Cope, Proc. Amer. Philos. Soc. 22:383.
- 1888 *Syrrhophus ridens*: Boulenger, Proc. Zool. Soc. London: 206.
- 1900 *Syrrhophus ridens*: Günther, Biol. Centr. Amer.: 216.
- 1928 *Syrrhopus molinoi* Barbour, Proc. N. Engl. Zool. Club 10:28 pl. 2,

Fig. 2 (Holotype: MCZ 13051: Panama: Canal Zone: Barro Colorado Island, Panama).

1931 *Eleutherodactylus lutosus molinoi*: Dunn, Occ. Pap. Boston Soc. Nat. Hist. 5:411.

1952 *Eleutherodactylus ridens*: Taylor, Univ. Kansas Sci. Bull. 35(5):690, Fig. 18.

Holotype.—Lost; Nicaragua: Rio San Juan.

This species was originally described from Atlantic versant Nicaragua near the boundary with Costa Rica. The original account Cope (1867) emphasized the areolate venter, reddish dorsal color and dark supratympanic mark, characteristic of individuals associated with this name. Taylor (1952:690) subsequently was the first to apply the name *ridens* to this form, since Costa Rica examples agreed with Cope's original account. My examination of Honduras and Nicaragua specimens confirms their conspecificity with Costa Rica examples. Although the type is lost, the brief type description cannot be associated with any other species and I follow Taylor's use of the name *E. ridens* for this form.

Barbour's (1928) *Syrrhopus molinoi* is based on a 19 mm female that agrees in detail with Costa Rica specimens in: lacking a well developed heel tubercle, and having one to several enlarged pointed supraocular tubercles and the finger disks expanded and rounded. Lynch (1980) concurs with this allocation based on an independent study of the situation and the holotype of *molinoi*. Dunn's (1931) placement of the latter as a subspecies of *lutosus* is clearly incorrect as may be seen from the account of *cruentus*, above, and the key presented below. Although Taylor (1952) recognized *ridens* in Costa Rica he failed to associate it with the Panamanian frogs called *molinoi*. Myers and Rand (1969) continued to use *molinoi* for this form on Barro Colorado Island as a result. Of the three species treated in this paper, *cerasinus* and *ridens* occur on Barro Colorado Island; all three occur in the Panama Canal Zone.

Eleutherodactylus ridens may be separated from other Central American species in the genus with which it might be confused (except *cerasinus* and *cruentus*) as follows, with features for *ridens* in parentheses: *E. caryophyllaceus*, *E. melanostictus*, and *E. taeniatus* have a well developed heel tubercle (absent); and *E. altae* and *pardalis* have the groin and anterior thigh marked with large light spots (no spots).

Eleutherodactylus ridens has the following known geographic range: the Atlantic lowlands of extreme eastern Honduras, Nicaragua, Costa Rica, and Panama; premontane evergreen forests of Costa Rica and Panama on both Atlantic and Pacific versants; lowlands of southwestern Costa Rica, and in the Pacific versant evergreen forests of Panama, western Colombia, and northwestern Ecuador (15-1200 m).

The following key will distinguish the three species discussed in this report.

1. A distinct well developed pointed to flap-like heel tubercle (calcar) 2
- Heel smooth or with a few small warts all of about the same size and similar to others scattered over upper surface of hind limb; disks round; surface of upper eyelid with one to several enlarged pointed supraocular tubercles; anterior and posterior surfaces of thigh, calf and feet red in life; no nuptial pads; but vocal slits present in adult males; males to 19 mm, females to 25 mm .. *Eleutherodactylus ridens*
2. A distinct, enlarged, pointed or flap-like supraocular or superciliary tubercle; subarticular tubercles under fingers and toes not pungent nor pointed, although often raised; tympanum indistinct (females) or completely hidden (males) under skin; disks truncate; usually one to several bright golden-yellow to orange spots in groin and on front of thigh in life, each outlined by dark pigment; often a series of oblique black flank bars; nuptial thumb pads but no vocal slits in adult males; males to 28 mm, females to 42 mm *Eleutherodactylus cruentus*
- No distinct enlarged supraocular nor superciliary tubercle, although a series of small superciliary tubercles usually present along margin of eyelid and several small warts on upper eyelid surface; some subarticular tubercles, at least under toes III–IV, pungent or pointed; tympanum thin, distinct; disks truncate; posterior thigh surface brown with red in groin, on anterior and posterior thigh surfaces and underside of calf, in life; no discrete dark and light markings in groin; no nuptial thumb pads but vocal slits present in adult males; males to 23 mm, females to 35 mm *Eleutherodactylus cerasinus*

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